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UTILIZATION OF ARTIFICIAL INSEMINATION (AI) BULLS IN THE
UNITED STATES IN 1968

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An examination of the number of first services to dairy bulls was made to determine the effective use that was being made of artificial insemination (AI) bulls in the United States. The AI organizations were asked to furnish information on the number of first services to individual bulls in 1968. Twenty-six organizations supplied data on the source of semen for 5,994,583 inseminations, thus giving information on 93 percent of all the dairy-to-dairy services to AI bulls in the United States in 1968. In four of the AI organizations the numbers of first services were estimated because the only information available was on the total ampules of semen used. These estimates were based on information available from the organizations on the average number of ampules required per breeding.

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Each bull was placed in one of the following categories according to the type of service he was in: regular service; available on special request only; in a progeny-test program. A regular-service code meant that semen was widely and generally available to the patrons. Many of those coded as special-request bulls were dead and only a limited supply of semen was available.

The numbers of bulls and the total numbers of inseminations are given by breed and type of service in table 1. Although 1,589 bulls were used, the 1,010 bulls in regular service accounted for 95 percent of the services while the progeny-test bulls accounted for 4 percent.

Table 2 shows that in every breed over 93 percent of the AI services were to regular-service bulls. A maximum of 4.7 percent of the services in any breed (Guernseys) was to bulls in a progeny-test program. The percentages of services from bulls in the special-mating category ranged from zero to 2.2 percent. With less than 5 percent of the services going to progeny-test bulls, it is likely that either not enough young bulls are being sampled or not enough inseminations are being made from each young bull. This is particularly true in the breeds other than Holstein because of the smaller population size.

About 84 percent of all inseminations in this study were to bulls of the Holstein breed (table 2). The Guernseys and Jerseys each accounted for about 6 percent of the services. The Brown Swiss, Ayrshire, and Milking Shorthorn breeds accounted for 2.5, 1.1, and 0.5 percent of the services, respectively.

The average number of inseminations per bull for each breed and type of services is given in table 3. All bulls in regular service averaged 5,649 inseminations. The Holsteins in regular service averaged 7,614 inseminations, three times that for the regular-service bulls of other breeds. One Holstein bull had 61,835 services, approximately three times as many as the highest bull in each of the Guernsey, Jersey, and Brown Swiss breeds. This most likely reflects differences

TABLE 1.--Number of bulls and inseminations by breed and type of service on which data for number of services by individual bulls were reported in 1968

Breed	Bulls				Services			
	Regular	Special mating	Progeny test	All used	Regular	Special mating	Progeny test	All used
----- <u>Number</u> -----								
Ayrshire-----	41	0	9	50	65,050	0	1,514	66,564
Guernsey-----	139	16	44	199	357,379	4,694	17,975	380,048
Holstein-----	628	72	354	1,054	4,781,400	53,352	181,493	5,016,245
Jersey-----	122	15	52	189	333,096	6,533	14,029	353,658
Brown Swiss--	56	5	11	72	141,892	3,333	5,914	151,139
M.Shorthorn--	20	1	0	21	26,474	207	0	26,681
Red Dane-----	4	0	0	4	248	0	0	248
Total-----	1,010	109	470	1,589	5,705,539	68,119	220,925	5,994,583

TABLE 2.--Percentage distributions of inseminations by breed and type of service and estimated total AI services for data available in 1968

Breed	Type of service			Total among breeds	Approximate total AI services by breed of bull in 1968 <u>2/</u> <u>3/</u>
	Regular	Special mating	Progeny test		
	<u>Percent</u> ^{1/}				<u>Number</u>
Ayrshire-----	97.7	0	2.3	1.1	71,000
Guernsey-----	94.1	1.2	4.7	6.3	407,000
Holstein-----	95.3	1.1	3.6	83.7	5,375,000
Jersey-----	94.2	1.8	4.0	5.9	379,000
Brown Swiss---	93.9	2.2	3.9	2.5	162,000
M. Shorthorn--	99.2	0.8	0	0.5	29,000
Red Dane-----	100.0	0	0	(4/)	248

1/ Percentages within breeds.

2/ Calculated by multiplying the 6,423,786 dairy-to-dairy services in 1968 by appropriate percentage.

3/ This represents number of services to all breeds of cows by bulls of all breeds in all types of services.

4/ Less than 0.05 percent.

TABLE 3.--Average number of inseminations per bull by breed and type of service and maximum number of services for an individual bull for data available in 1968

Breed	Type of service			Overall	Maximum services for an individual bull
	Regular	Special mating	Progeny test		
----- <u>Number</u> -----					
Ayrshire-----	1,587	0	168	1,331	8,648
Guernsey-----	2,571	293	409	1,910	20,480
Holstein-----	7,614	741	513	4,759	61,835
Jersey-----	2,730	436	270	1,871	18,848
Brown Swiss--	2,534	667	538	2,099	21,568
M. Shorthorn-	1,324	207	0	1,271	4,716
Red Dane-----	62	0	0	62	114

in demands considering that a New Zealand summary^{2/} shows that maximum service was from Jersey bulls. Ten New Zealand Jersey bulls used as extensively as possible in 1967 because of high milk fat ratings on their daughters averaged 43,188 inseminations, and one of these had 59,451 inseminations. The nine New Zealand Holsteins having the highest milk fat rating averaged 25,446 inseminations, and the maximum number of inseminations for an individual bull was 40,651.

Table 4 shows the distribution of regular-service bulls with regard to the number of inseminations. It is clear that many of the bulls will have little impact upon the population as a result of 1968 services. The 346 bulls that were bred to 5,000 or more cows accounted for 81 percent of the services while the other 664 bulls accounted for 19 percent.

It is clear that complete utilization has not been made of the AI bulls in regular service. Only 285 bulls would have been needed in 1968 instead of the 1,010 used if 20,000 inseminations had been made to each in regular service. Based on New Zealand results ^{2/} it appears that an AI organization trying to make full use of their best bulls could average more than 20,000 inseminations to each. Even at 10,000 inseminations per regular-service bull, only 571 bulls would have been needed to inseminate the 5,705,539 cows bred. This would have permitted the elimination of the lowest 43 percent of the bulls based on production data, or would have allowed more selection among bulls on the basis of other economically important traits in addition to yield.

The number of inseminations that were made to bulls coded as special request and on progeny test are given in tables 5 and 6, respectively. Sixty-one bulls coded as being on progeny test had more than 1,000 services, and two of these had more than 5,000 services. The other 409 progeny-test bulls each had less than 1,000 services in 1968.

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^{2/} New Zealand Dairy Board, Artificial Breeding, Seventh Annual Report, No. 44, 1967-68 season.

TABLE 4.--The distribution of bulls in regular service by breed and number of inseminations for data available in 1968

Breed	Inseminations per bull grouped by interval				
	1 to 999	1,000 to 4,999	5,000 to 9,999	10,000 to 19,999	20,000 and over
----- <u>Number</u> -----					
<u>Bulls in each class</u>					
Ayrshire-----	17	23	1	0	0
Guernsey-----	59	61	12	6	1
Holstein-----	129	203	135	102	59
Jersey-----	49	51	16	6	0
Brown Swiss--	25	23	6	1	1
M. Shorthorn-	9	11	0	0	0
Red Dane-----	4	0	0	0	0
<u>Services to bulls in each class</u>					
Ayrshire-----	5,140	51,262	8,648	0	0
Guernsey-----	18,321	160,869	88,848	68,861	20,480
Holstein-----	50,934	577,455	944,844	1,462,516	1,745,651
Jersey-----	19,882	119,631	121,260	72,323	0
Brown Swiss--	7,504	58,035	37,844	16,941	21,568
M. Shorthorn-	1,904	24,570	0	0	0
Red Dane-----	248	0	0	0	0

TABLE 5.--The distribution of bulls in service available only through special request by breed and number of inseminations for data available in 1968

Breed	Inseminations per bull grouped by interval		
	1 to 999	1,000 to 4,999	5,000 to 9,999
----- <u>Number</u> -----			
<u>Bulls in each class</u>			
Ayrshire-----	0	0	0
Guernsey-----	14	2	0
Holstein-----	56	14	2
Jersey-----	14	1	0
Brown Swiss-----	4	1	0
M. Shorthorn----	1	0	0
Red Dane-----	0	0	0
<u>Services to bulls in each class</u>			
Ayrshire-----	0	0	0
Guernsey-----	1,326	3,368	0
Holstein-----	14,562	25,815	12,975
Jersey-----	4,410	2,123	0
Brown Swiss-----	1,333	2,000	0
M. Shorthorn----	207	0	0
Red Dane-----	0	0	0

TABLE 6.--The distribution of bulls in service only for progeny testing by breed and number of inseminations for data available in 1968

Breed	Inseminations per bull grouped by interval		
	1 to 999	1,000 to 4,999	5,000 to 9,999
----- <u>Number</u> -----			
<u>Bulls in each class</u>			
Ayrshire-----	9	0	0
Guernsey-----	40	4	0
Holstein-----	302	50	2
Jersey-----	48	4	0
Brown Swiss-----	10	1	0
M. Shorthorn----	0	0	0
Red Dane-----	0	0	0
<u>Services to bulls in each class</u>			
Ayrshire-----	1,514	0	0
Guernsey-----	9,755	8,220	0
Holstein-----	79,193	91,874	10,426
Jersey-----	8,878	5,151	0
Brown Swiss-----	4,424	1,490	0
M. Shorthorn----	0	0	0
Red Dane-----	0	0	0

Inseminations averaging 20,000 per year and four years of useful life from each new bull put in regular service means that at least 60 Holsteins, 4 Guernseys, 4 Jerseys, 2 Brown Swiss, and 1 Ayrshire must be placed in regular service each year. It appears that overall there are not enough bulls being sampled through progeny testing to maintain the number of bulls needed in regular service in each breed and at the same time have a satisfactory selection differential on the bulls placed in regular service. This deficiency could result in two possibilities: (1) AI progeny-tested bulls with less-than-superior genetic merit for yield will be placed in regular service just to get the cow population bred and/or; (2) bulls with non-AI preliminary summaries will be placed in regular service before precise information on their transmitting ability in the general population is known.

Table 7 shows the distribution of all bulls with regard to the number of inseminations. The basis of the more effective utilization of Holstein bulls is evident in that a higher percentage of the bulls of that breed had over 5,000, 10,000, and 20,000 services each.

Some changes in patterns of insemination are apparent by comparing the data for 1967 and 1968. The comparisons between the two years were made using only data from AI organizations that reported individual number of services in both the years being compared. The numbers of bulls included in the averages are given in table 8 and the changes in the average number of inseminations per bull are given in table 9. The average inseminations per regular-service bull decreased from 1967 to 1968 for each breed except Brown Swiss and Red Dane. The average number of inseminations per progeny-test bull decreased for all breeds having a progeny-test program.

Table 10 shows changes in the percent distribution of inseminations going to the various types of bulls. In the breeds other than Ayrshire, the percent of services going to regular-service bulls gained at the expense of bulls in other categories. This is a shift that may produce deficiencies in the number of new bulls entering service with precise genetic proofs in future years.

TABLE 7.--The distribution of bulls by breed and number of inseminations for data available in 1968

Breed	Inseminations per bull in all categories of service				
	1 to 999	1,000 to 4,999	5,000 to 9,999	10,000 to 19,999	20,000 and over
----- <u>Number</u> -----					
	<u>Bulls in each class</u>				
Ayrshire-----	26	23	1	0	0
Guernsey-----	113	67	12	6	1
Holstein-----	487	267	139	102	59
Jersey-----	111	56	16	6	0
Brown Swiss--	39	25	6	1	1
M. Shorthorn-	10	11	0	0	0
Red Dane-----	4	0	0	0	0
<u>Services to bulls in each class</u>					
----- <u>Percent</u> -----					
Ayrshire-----	10.0	77.0	13.0	----	----
Guernsey-----	7.7	45.4	23.4	18.1	5.4
Holstein-----	2.9	13.9	19.3	29.2	34.8
Jersey-----	9.4	35.9	34.3	20.4	----
Brown Swiss--	8.8	40.7	25.0	11.2	14.3
M. Shorthorn-	7.9	92.1	----	----	----
Red Dane-----	100.0	----	----	----	----

TABLE 8.--Number of bulls by breed and type of service for data available for 1967 and 1968^{1/}

Breed	Type of service						Overall	
	Regular		Special mating		Progeny test			
	Bulls used in-		Bulls used in-		Bulls used in-		Bulls used in-	
	1967	1968	1967	1968	1967	1968	1967	1968
----- <u>Number</u> -----								
Ayrshire-----	40	41	3	0	3	9	46	50
Guernsey-----	134	135	22	13	48	44	205	192
Holstein-----	607	613	84	65	337	345	1,028	1,023
Jersey-----	114	113	17	15	67	50	198	178
Brown Swiss---	56	55	7	5	18	11	81	71
M. Shorthorn--	18	20	2	1	2	0	22	21
Red Dane-----	4	4	0	0	0	0	4	4

^{1/} Comparisons are made only on identical AI studs reporting for 1967 and 1968.

TABLE 9.--Comparison of average number of inseminations per bull by breed and type of service for data available for 1967 and 1968 ^{1/}

Breed	Type of service			Overall
	Regular	Special mating	Progeny test	
	Changes in average number of inseminations per bull from 1967 to 1968			
----- <u>Number</u> -----				
Ayrshire-----	-539	-196	-317	-562
Guernsey-----	-371	-319	-409	-270
Holstein-----	-243	-488	-412	-259
Jersey-----	-493	-607	-95	-216
Brown Swiss----	+454	-175	-708	+309
M. Shorthorn---	-46	+138	-2,570	-90
Red Dane-----	+8	0	0	+8

^{1/} Comparisons are made only on identical AI studs reporting for 1967 and 1968.

TABLE 10.--Comparison of percentage distributions of inseminations by breed and type of service for data available for years 1967 and 1968

Breed	Type of service			Changes in percent of cows bred by bulls of different breeds from--1967 to 1968
	Regular Change from--1967 to 1968	Special mating Change from--1967 to 1968	Progeny test Change from--1967 to 1968	
----- Percent ^{1/} -----				
Ayrshire----	0	-0.7	+0.6	-0.3
Guernsey----	+5.8	-2.0	-3.8	-.7
Holstein----	+3.4	-1.0	-2.4	+1.6
Jersey-----	+4.1	-2.3	-1.9	-.9
Brown Swiss-	+13.2	-1.8	-11.3	+2
M.Shorthorn-	+16.8	+3	-17.2	-.1
Red Dane----	0	----	----	(2/)

^{1/} Percentages within breeds.

^{2/} Less than 0.05 percent.

Table 11 indicates that the total number of inseminations from bulls having under 1,000 or over 10,000 services while in regular service has decreased, while total services from bulls having between 1,000 and 10,000 inseminations increased from 1967 to 1968. This more nearly balanced distribution of services for bulls means that the effective number of AI bulls in service increased slightly from 1967 to 1968. The decrease in total services for bulls with more than 10,000 inseminations also explains the slight decrease in the average inseminations per bull.

These results raise a few questions that dairymen and AI units should consider because of the economic importance they have upon their particular organization. Are all bulls now kept for regular service really needed, or is it possible to accelerate genetic improvement for the dairymen and reduce semen production costs by greater utilization of fewer bulls? A second question the dairymen should ask the particular organization they are purchasing service from is: Are enough bulls being sampled in your stud through a progeny-test program to offer a satisfactory base from which to select proven sires for regular use?

TABLE 11.--Comparison of the distribution of bulls in regular service by breed and number of inseminations for data available for 1967 and 1968

Breed	Inseminations per bull grouped by interval				
	1 to 999	1,000 to 4,999	5,000 to 9,999	10,000 to 19,999	20,000 and over
Percent of total regular dairy services in 1968 ^{1/2/}					
Ayrshire-----	0.1	0.9	0.2	-----	-----
Guernsey-----	.3	2.8	1.6	1.2	0.4
Holstein-----	.9	10.1	16.6	25.6	30.6
Jersey-----	.4	2.1	2.1	1.3	-----
Brown Swiss--	.1	1.0	.7	.3	.4
M. Shorthorn-	(3/)	.4	-----	-----	-----
Actual change for 1967 to 1968 in number of services					
Ayrshire-----	-1,071	+882	-5,633	-14,164	-----
Guernsey-----	-7,982	+16,580	+5,565	-6,742	-54,554
Holstein-----	-2,867	+117,360	+38,151	-125,863	-127,792
Jersey-----	-965	+17,978	+6,150	-50,116	-32,176
Brown Swiss--	-3,336	+8,414	-497	+16,941	+1,356
M. Shorthorn-	-2,054	+3,865	-----	-----	-----

1/ Data for 1968 are percentages of all inseminations within a class interval in the regular service category.

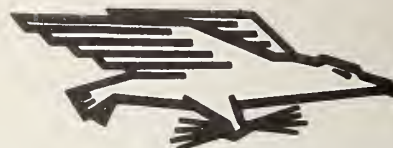
2/ See table 4 for the distribution of bulls by breed and number of inseminations in the regular-service category.

3/ Less than .05 percent.

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